

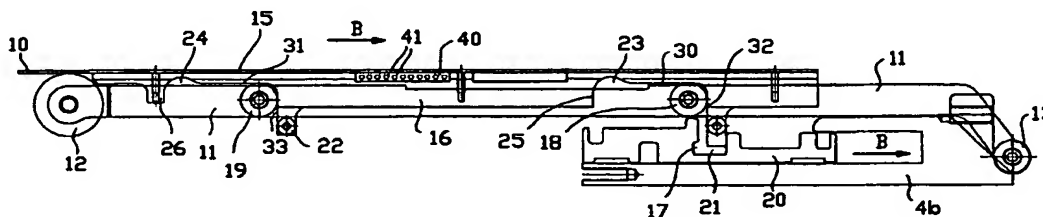
(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau(43) International Publication Date
20 September 2001 (20.09.2001)

PCT

(10) International Publication Number
WO 01/68356 A1

- (51) International Patent Classification⁷: **B29D 30/24 // 30/32**
- (21) International Application Number: **PCT/NL01/00219**
- (22) International Filing Date: **16 March 2001 (16.03.2001)**
- (25) Filing Language: **Dutch**
- (26) Publication Language: **English**
- (30) Priority Data:
1014687 17 March 2000 (17.03.2000) **NL**
- (71) Applicant (for all designated States except US): **VMI EPE HOLLAND B.V. [NL/NL]; Gelriaweg 16, NL-8161 RK Epe (NL).**
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): **DE GRAAF, Martin [NL/NL]; Vlekkertseveld 6, NL-8166 KZ Emst (NL). GUTKNECHT, Heinz [NL/NL]; Torenweg 26, NL-8161 AT EPE (NL). HUISMAN, Henk [NL/NL]; Allendelaan 6, NL-8161 DA Epe (NL). DE VRIES, Wubbo, Pieter [NL/NL]; De Wrongel 17, NL-7908 NZ Hoogeveen (NL).**
- (74) Agent: **DE HOOP, Eric; Octrooibureau Vriesendorp & Gaade, P.O. Box 266, NL-2501 AW The Hague (NL).**
- (81) Designated States (national): **AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.**
- (84) Designated States (regional): **ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).**
- Declarations under Rule 4.17:**
- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for all designations except US*
 - *of inventorship (Rule 4.17(iv)) for US only*
- Published:**
- *with international search report*
 - *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*
- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

(54) Title: **TYRE BUILDING DRUM PROVIDED WITH A TURN-UP DEVICE**

(57) Abstract: Tyre drum (1) including a turn-up mechanism for use in building an unvulcanized tyre having tyre components of rubber or provided with reinforcement cords and two bead cores which either may or may not be provided with a bead filling strip, which tyre drum is provided with a central axis (5), two ring segments (6) placed around the axis and spaced apart each for supporting a bead core (3), means for radially expanding the part of the tyre components that is situated within the ring segments, in which the tyre building drum on either side outside of the ring segments is provided with a set of radially extending hinged arms (11), in which each arm is provided with an end oriented towards the ring segment which end has a first turn-up means, such as a first roller (12), means (20) for axially and radially moving each set of arms from a first position in which the first rollers of the set of arms form a virtually closed ring into an expanded second position for pressing the part of the tyre components situated outside of the ring segments against the expanded part of the tyre components situated within the ring segments, in which the arms at the ends near the first rollers are provided with moveable support surfaces (15) which in the first position form a virtually closed cylindrical surface for supporting the tyre components.

WO 01/68356 A1

TYRE BUILDING DRUM PROVIDED WITH A TURN-UP DEVICE

The present invention relates to a tyre drum including a turn-up mechanism for use in building an unvulcanized tyre having tyre components of rubber or provided with reinforcement cords and two bead cores which either may or may not be provided with a bead filling strip, which tyre drum is
5 provided with a central axis, two ring segments placed around the axis and spaced apart each for supporting a bead core, means for radially expanding the part of the tyre components that is situated within the ring segments, in which the tyre drum on either side outside of the ring segments is provided with a set of radially extending hinging arms, in which each arm
10 is provided with an end oriented towards the ring segment which end has a first turn-up means, such as a first roller, means for axially and radially moving each set of arms from a first position in which the first rollers of the set of arms form a virtually closed ring into an expanded second position for pressing the part of the tyre components situated outside of
15 the ring segments against the expanded part of the tyre components situated within the ring segments.

Such tyre drums provided with a turn-up mechanism are generally known. They may be designed as tyre building drum on which the tyre components, in particular liner and carcass layers are supplied and of which a
20 cylindrical casing is being made, and also bead cores are supplied, after which the cylindrical casing on the tyre building drum is expanded into a curved torus shape, in which the sides of the casing are turned up about the bead cores by means of the turn-up mechanism. They may also be
25 designed as a curving drum, to which an already formed cylindrical carcass casing has been supplied.

- 2 -

Such a tyre building drum including turn-up mechanism is known from British patent specification 1.532.960. When building a tyre, portions of the tyre components end up on the arms. Because there is room between the arms, and the arms may leave imprints in the portions of the tyre components, it has appeared that an accurate tyre cannot be manufactured with said known building drum in all cases.

It is an object of the present invention to provide a tyre drum including a turn-up mechanism having arms, with which tyres can be manufactured in an accurate manner.

From one aspect the invention to that end provides a tyre drum of the kind mentioned in the preamble, in which the arms at the ends near the first rollers are provided with moveable support surfaces which in the first position form a virtually closed cylindrical surface for supporting the tyre components. Because in the first position the arms form a virtually closed cylindrical surface, an optimal surface is created to accurately arrange and splice the tyre component in question, and after that the rolling during the movement of the arms to the expanded second position and back again can take place without trouble and the tyre components can be rolled without air enclosures arising.

Preferably the support surfaces extend up to the end of the arm in question including roller. Also at the location of the roller a -removable- surface then may or may not be provided to the tyre components when desired.

Preferably each support surface is arranged moveable in arm direction on the arm in question. In that way the arm may have a function in the support and guidance of the moveable support surface.

In a further development, the support surface can be moved in arm direction between a first position, in which the roller is covered radially to the

- 3 -

outside, and a second, retracted position, in which the roller is uncovered in radial outward direction. In the second position the roller can offer an idle support to the tyre components during turning-up.

5 Preferably each support surface is arranged moveable in radial direction on the arm in question between a third, radially expanded position and a fourth, with respect to the roller, radially retracted position. The support surfaces here pull themselves loose from the tyre material they previously supported.

10

Preferably the first and the third position of the support surface coincide, and preferably the second and fourth position coincide, as a result of which the movements can be efficiently realised.

15 In a first further development the support surface is formed by a cover plate that can be moved on the arm. The construction of the arm may substantially be as usual, for instance thin and light, in which the cover plate is formed as an extra part with a support surface for the tyre components.

20

Preferably the cover plates are provided with a drive member forming a unity with them, which drive member engages in an axially slidable drive for moving the cover plates, in which the drive member extends radially freely in a driving slide for movement along the arms in the first position of
25 the arms, so that the movement of the arms can take place easily and without trouble.

25

Preferably the cover plate and the arm in question are provided with stops for limiting the relative movement, so that the functioning is always
30 certain.

30

When the arms are brought into the extended position, the portion in

- 4 -

question of the tyre components slides over the arms. With certain kinds of rubber of which the tyre components have been made, such sliding may cause unwanted friction, as a result of which the final quality of the tyre built leaves something to be desired. According to the invention this is
5 solved in that in a second further development each arm is provided with a second roller which is spaced apart from the said roller, and in which the support surface is formed by an endless belt, which has been placed about the first and second roller and in which the endless belts are situated adjacently in the first position of the arms to define an at least virtually
10 closed circumferential surface. The -idle- belt can move along with the tyre components during the turning-up process, so that the frictional forces can remain limited.

Preferably the second roller is biased away from the first roller by means
15 of a spring, in which the spring preferably is attached to the arm in question, so that the belt can always remain at tension.

Preferably the sets of hinging arms on either side outside of the ring segments can be moved synchronously by a mechanical coupling from the
20 first to the second position.

Some embodiments of a tyre (building) drum including turn-up mechanism having arms according to the invention, are described below by way of example on the basis of the drawing, in which:

25 Figures 1A up to and including 1D schematically show a longitudinal section of a tyre building drum including turn-up mechanism according to the invention for building an unvulcanized tyre, in several process steps;

30 Figures 2A and 2B show two positions of a support surface on an arm in the tyre building drum of the figures 1A-1D; and

- 5 -

Figure 3 shows an alternative embodiment according to the invention of a part of the tyre building drum.

Figures 1A up to and including 1D schematically show a longitudinal section of a tyre building drum 1 including turn-up mechanism according to the invention for building an unvulcanized (radial) tyre, in several treatment steps. Such an unvulcanized tyre contains tyre components 2 of rubber, possibly provided with reinforcement cords, (in the stage shown in figure 1 the tyre components used are: a so-called liner having two sides 2a and a carcass layer) and two bead cores 3 having -in this case- a high bead filling strip on it. The number and the type of tyre components depend on the tyre to be manufactured in the end, and the possible compositions and structure are sufficiently known to the expert, so that a further discussion of this can be dispensed with here.

The tyre building drum 1 is provided with a central shaft 5. About the shaft 5 and at a distance from each other two annular bead clamping segments 6 have been placed, each for supporting accompanying bead cores 3 and provided with moveable inner supports 45, which prevent the carcass from being pressed from the annular segments 6 during formation (figure 1D).

Figure 1 shows an example of a tyre building drum. As is known, there are means (not shown in the figure) in this case for radially expanding the part of the tyre components that is situated within the segments 6 -for instance by means of air pressure-.

Two annular cylinders 4a have also been arranged -on both ends- about the shaft 5, in which cylinders 4a pistons 7 extend. At the location of hinge points 13 turn-up arms 11 are connected to the cylinders 4a, which turn-up arms at their other ends are provided with idle "first" turn-up and pressing roller 12. It will be understood that the tyre building drum is substantially symmetrical, in which in the centre the surface of symmetry

- 6 -

extends transverse to the shaft 5.

In the figures 2A and 2B the structure of the arms 11 is further illustrated. The arms 11 are elongated and together with the roller 12 serve to turn up
5 the tyre components against the expanded carcass. The arm 11 here is furthermore provided with an elongated cover plate 15 placed over the arm 11, which cover plate forms a support surface 10 at the end. At the other end the cover plate 15 is provided with a driving cam 21, which extends into a recess 17 of a piston 20, which extends into the cylinder 4b which
10 forms a moveable unity with the above-mentioned cylinder 4a, but which is axially and oppositely oriented. On the longitudinal sides the arm 11 is provided with support rollers 18 and 19 for the cover plate 15, which rests on them with edges 30 and 31, which in the direction towards the roller 12 merge into an elevated edge portion 23 and 24, respectively. Said
15 portions merge into stop edges 25 and 26, respectively, which with opposite stop edges 32 and 33 define the axial movement space for the rollers 18 and 19 (relatively considered). The cover plate 15 is locked against lifting too far (further than the position shown in figure 2A) with respect to the arm 11 by transverse pin 22a attached to the pending side
20 walls 16 of the cover plate 15, in particular pending lips 22, which pin 22a extends under the arm 11. A comparable confining pin 21a is arranged on driving cam 21.

Furthermore, elongated recesses 40 have been made in the side walls 16,
25 through which recesses tension springs 41 extend, which extend circumferentially about the drum 1 and serve to urge the arms 11 into the resting position in a resilient manner, in a manner known per se. The draw springs 41, because they are secured to the cover plate 15, also exert a downward force directed towards the arm 11 on the cover plate 15.

30

As can be seen when comparing the figures 2A and 2B, the movement of the piston 20 in the cylinder 7 in the direction B will carry along the cam

- 7 -

21, so that also the cover plate 15 is moved in the direction B, which direction is parallel to the arm 11 and to the axial main axis of the tyre building drum. As a result the support surface 10 will move to the right, and finally entirely free the roller 12, so that during turning up its upper surface as well can be active in contact with tyre components. After the end of the cover plate 15 has passed by the roller 12, the elevated edge portions 23 and 24 will also have ended up at the location of the rollers 18 and 19, so that the cover plate 15 is also able to go down in the direction C with respect to the arm 11. The position shown in figure 2B is then achieved. The cover plate 15 then is in the entirely retracted position. The roller 12 can then also extend radially above the support surface 10, so that the tyre components come entirely loose from it and can roll along it during turning up.

Thus an at least virtually closed circumferential surface for supporting tyre components can be obtained in the initial stage of building. In this way an optimal surface is created for accurately placing the tyre components in question. By way of example for a circumferential surface formed by support surfaces in the resting position of approximately 15 inches, having two groups of forty-eight arms on each side of the plane of symmetry the movement distance in the direction B is 34 mm, and in the direction C 3 mm (so a difference in diameter of 6 mm), in case of an intermediate distance, considered in circumferential direction of the cover plates 15 in the position of the figure 2A of 0.2 mm, which makes the movement in direction C possible and still gives an effectively continuous circumferential surface for the tyre components in the position of figure 2A. The width of the support surfaces here is 23 mm. In the position of figure 2B the cover plates 15 lie against each other in circumferential direction.

The position shown in figure 2A corresponds to the one of figure 1A, in which the tyre components have been placed. The circumferential surface then has the largest diameter, with little slits of 0.2 mm between the

- 8 -

support surfaces 10. The tyre components 2, in the shape of a liner (inner liner) having two side walls 2a, are applied, and after that one or more cord layers (ply) and possible reinforcement strips. By means of a ply-splice stitcher roller that is moved in axial direction over the circumference the layers are spliced together, so that a cylindrical tyre casing is created. The
5 aforementioned little slits are too narrow to accommodate the pressed soft material of the liner.

Subsequently the bead clamping segments 6 are radially expanded, so that
10 they extend radially above the support surface 10. They clamp the tyre material around the bead core 3 in order to ensure an airtight clamping. The tyre material 2a is loosened a little already from the support surfaces 10 at that location by the upward pressing. This is shown in figure 1B.

At that moment the piston/cylinder 20/4b can be operated, so that the
15 cover plates 15 of all arms are simultaneously slid in the direction B and a little downward in the direction C. The circumferential surface then takes up its smallest diameter i, in which the cover plates with the support surfaces 10 define a slit-less circumferential surface of the drum. The tyre
20 material is then entirely and circumferentially pulled loose from the support surfaces. This stage is shown in figure 1C. In that way the rollers 12 come to lie completely free, in order to be completely effective during the subsequent turning up of the tyre components and rolling them. The distance between the bead clamping segments 6 is reduced so that the
25 distance between the beads 3 is also made smaller, and the internal bead supports 45 move upward. Because of the pressurized air supplied from the inside the cylindrical carcass casing starts to expand into a torus shape.

Immediately after that the turn-up mechanism is activated, in which the
30 arms 11 amongst others by operating the piston/cylinders 7/4a, are axially moved towards each other (considered on either side of the surface of

- 9 -

symmetry). With the rollers 12, they move radially to the outside as well, counter to the spring tension of the draw springs 41. The tyre components 2a are here turned up about the bead 3 and against a side wall of the torus shaped carcass by the rollers 12. In the extremest position of the arms
5 they are situated in the position shown in figure 1D. During the upward movement of the rollers 12 the sideward tyre components are able to roll over them without trouble until in abutment against the side walls of the tyre to be made.

10 It is noted that the movement of the cover plates 15 may possibly be controlled separately, or in another way mechanically coupled to the movement of another construction part of the building drum, for instance with the upward movement of the bead clamping segments, in particular the lateral inner shoulders 45 which support the bead cores 3 sideward.

15 When the arms are brought into the second position, the portion in question of the tyre components slides over the arms. In order to reduce this friction the alternative embodiment according to figure 3 is suggested. Here each arm 111 of the set of arms is provided with a second roller 123
20 which is placed at a distance from the first roller 112. An endless conveyor belt 124 has been placed around the first 112 and second 123 rollers. The endless conveyor belts 124 of the arms 111 are situated adjacent to each other in the first position (in figure 3 the horizontal position). During the movement of the arms from the first to the second position (in figure 3 the
25 inclined position) the conveyor belt 124 moves along such with the rubber components A (indicated by arrow D) that at least almost no friction arises any more. As a result it is also prevented that unwanted stretch in the tyre components arises.

30 In order to keep the conveyor belt 124 taut, the second roller 12 is suspended from the arm 111 by means of a spring 125.

(octrooi\163063\des AF/NG 2863)

Claims

1. Tyre drum including a turn-up mechanism for use in building an unvulcanized tyre having tyre components of rubber or provided with reinforcement cords and two bead cores which either may or may not be provided with a bead filling strip, which tyre drum is provided with a central axis, two ring segments placed around the axis and spaced apart each for supporting a bead core, means for radially expanding the part of the tyre components that is situated within the ring segments, in which the tyre drum on either side outside of the ring segments is provided with a set of radially extending hinging arms, in which each arm is provided with an end oriented towards the ring segment which end has a first turn-up means, such as a first roller, means for axially and radially moving each set of arms from a first position in which the first rollers of the set of arms form a virtually closed ring into an expanded second position for pressing the part of the tyre components situated outside of the ring segments against the expanded part of the tyre components situated within the ring segments, in which the arms at the ends near the first rollers are provided with moveable support surfaces which in the first position form a virtually closed cylindrical surface for supporting the tyre components.
2. Tyre drum according to claim 1, in which each support surface extends up to the end of the arm in question including roller.
3. Tyre drum according to claim 1 or 2, in which the support surface can be moved in arm direction.
4. Tyre drum according to claim 3, in which each support surface can be moved in arm direction on the arm in question between a first position, in

- 11 -

which the roller is covered radially to the outside, and a second, retracted position, in which the roller is uncovered in radial outward direction.

- 5 5. Tyre drum according to any one of the claims 1-4, in which each support surface is arranged moveable in radial direction on the arm in question between a third, radially expanded position and a fourth, with respect to the roller, radially retracted position.
- 10 6. Tyre drum according to claim 4 and 5, in which the first and the third position of the support surface coincide.
7. Tyre drum according to claim 4 and 5, in which the second and fourth position coincide.
- 15 8. Tyre drum according to any one of the preceding claims, in which the support surface is formed by a cover plate that can be moved on the arm.
- 20 9. Tyre drum according to claim 8, in which the cover plates are provided with a drive member forming a unity with them, which drive member engages in an axially slidable drive for moving the cover plates, in which the drive member preferably extends radially freely in a driving slide for movement along the arms in the first position of the arms.
- 25 10. Tyre drum according to claim 8 or 9, in which the cover plate and the arm in question are provided with stops for limiting the relative movement.
- 30 11. Tyre drum according to any one of the preceding claims, in which the arms are biased towards the first position by means of a circumferential tensioning ring, and in which the tensioning ring is connected to the cover plates, in particular extending through it.
12. Tyre drum according to claim 11, in which the tensioning ring directly

- 12 -

engages on the cover plates and via the cover plates on the arms.

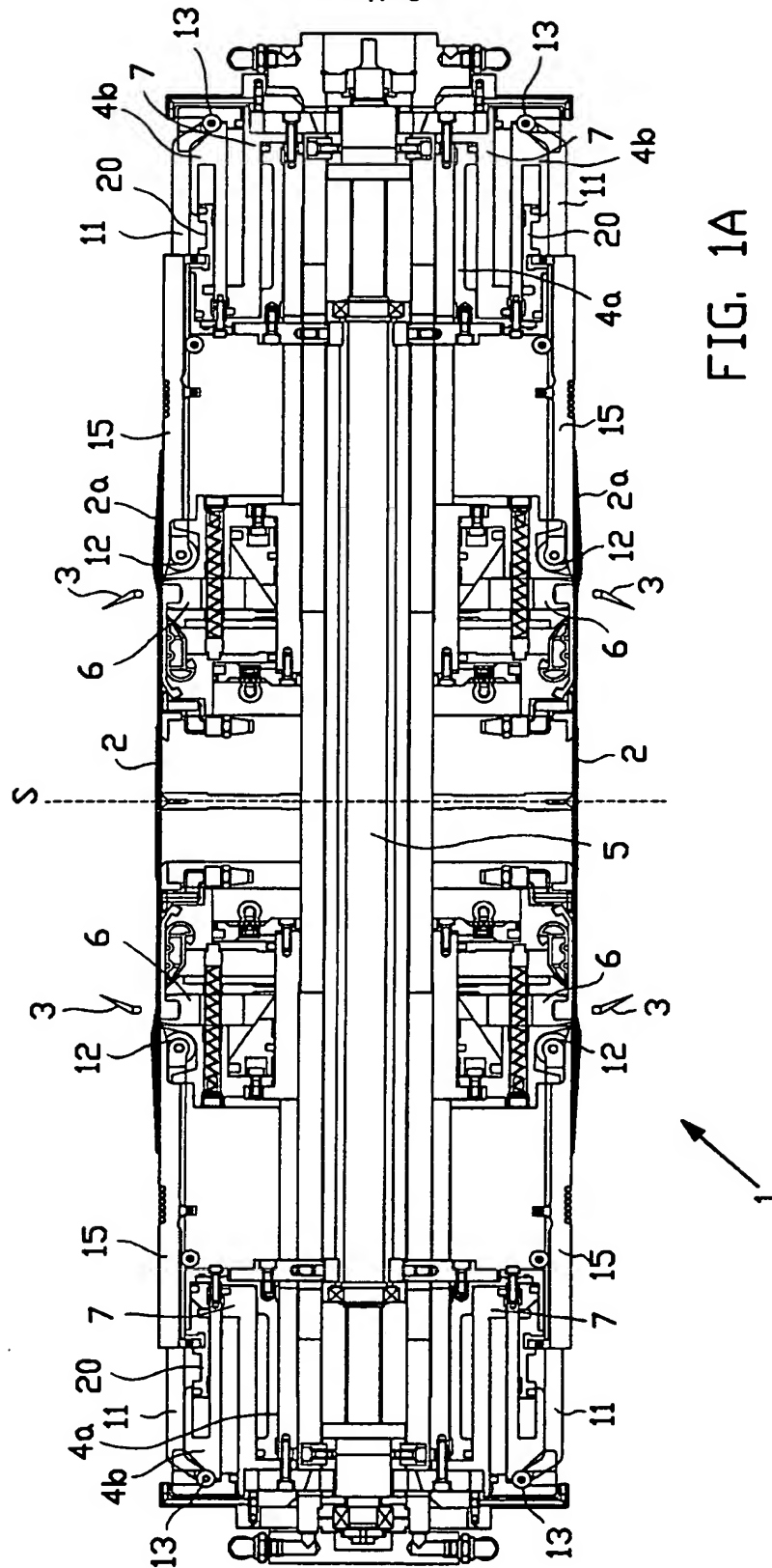
5 13. Tyre drum according claims 1, 2 or 3, in which each arm is provided with a second roller which is spaced apart from the said roller, and in which the support surface is formed by an endless belt, which has been placed about the first and second roller and in which the endless belts are situated adjacently in the first position of the arms.

10 14. Tyre drum according to claim 13, in which the second roller is biased away from the first roller by means of a spring, in which the spring preferably is attached to the arm in question.

15 15. Tyre drum according to any one of the preceding claims, in which the sets of hinging arms on either side outside of the ring segments can be moved synchronously by a mechanical coupling from the first to the second position.

16. Tyre drum according to any one of the preceding claims, equipped as tyre building drum.

1/6



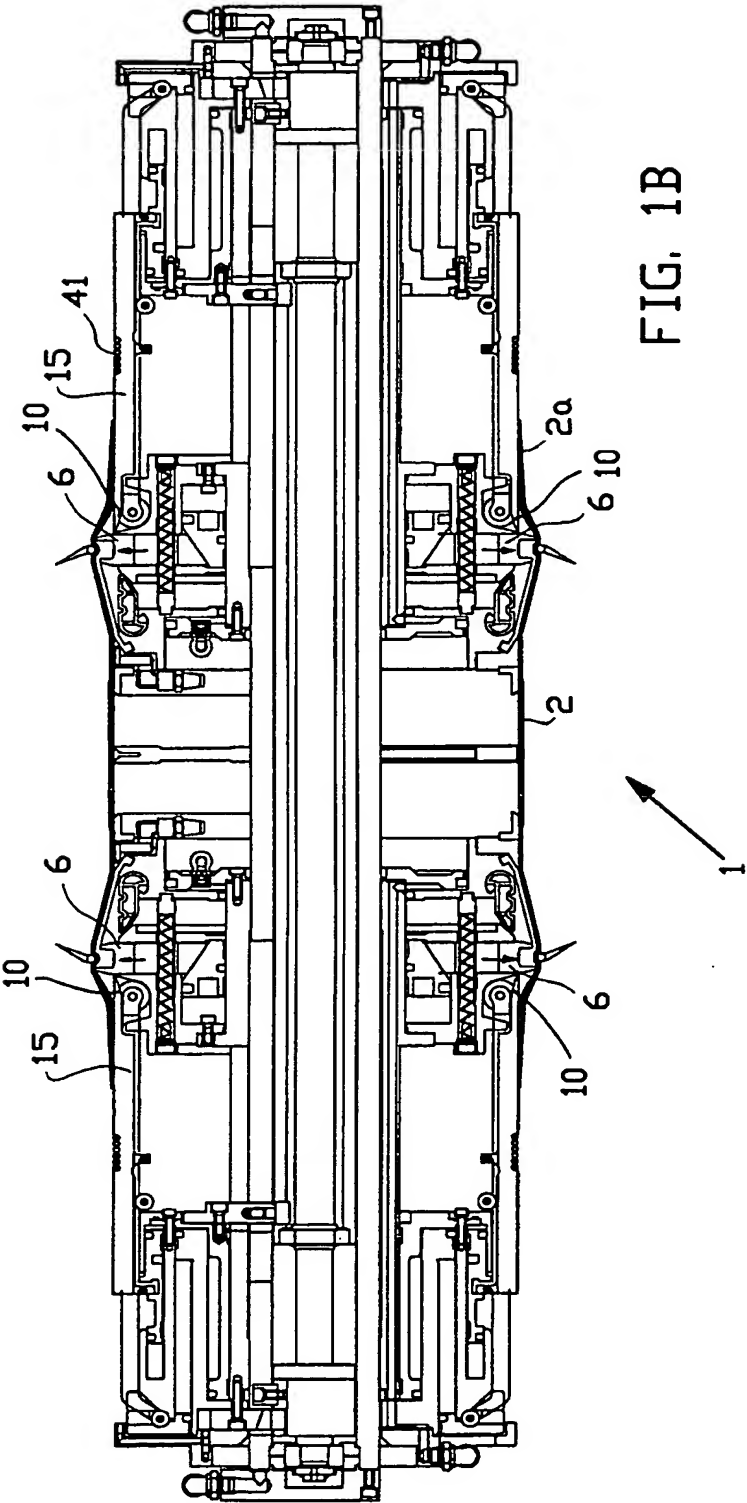
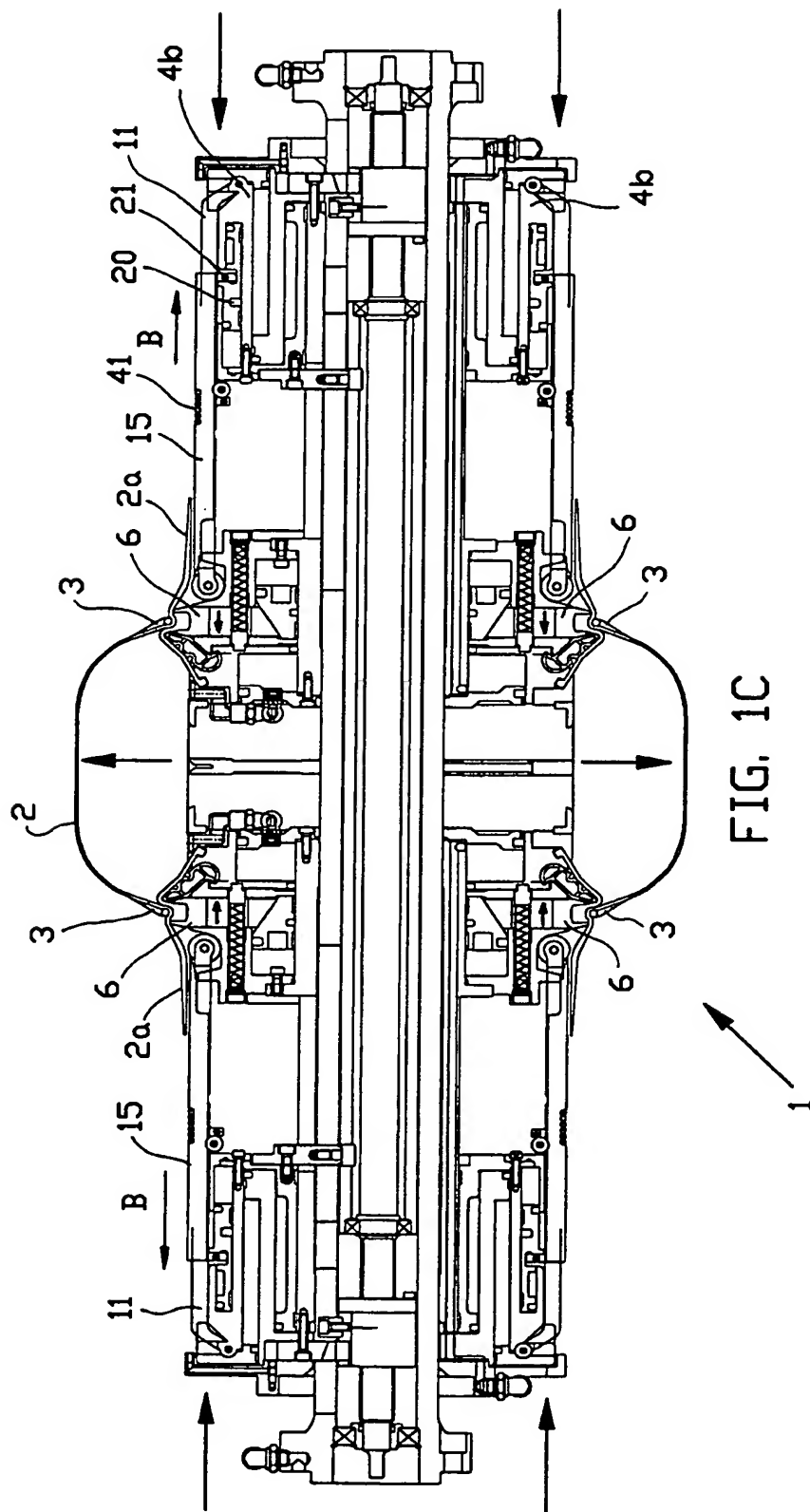
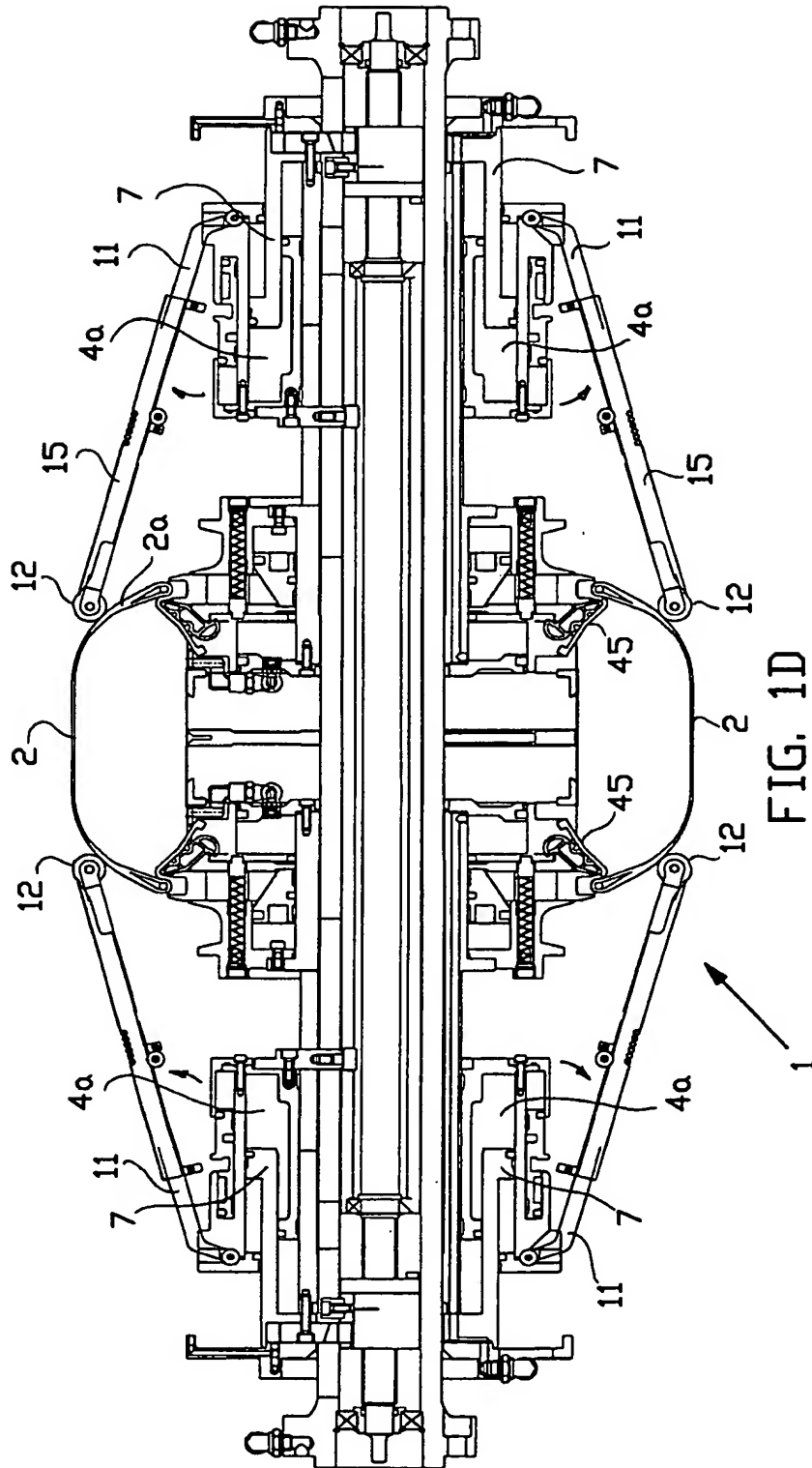


FIG. 1B

3/6



4/6



5/6

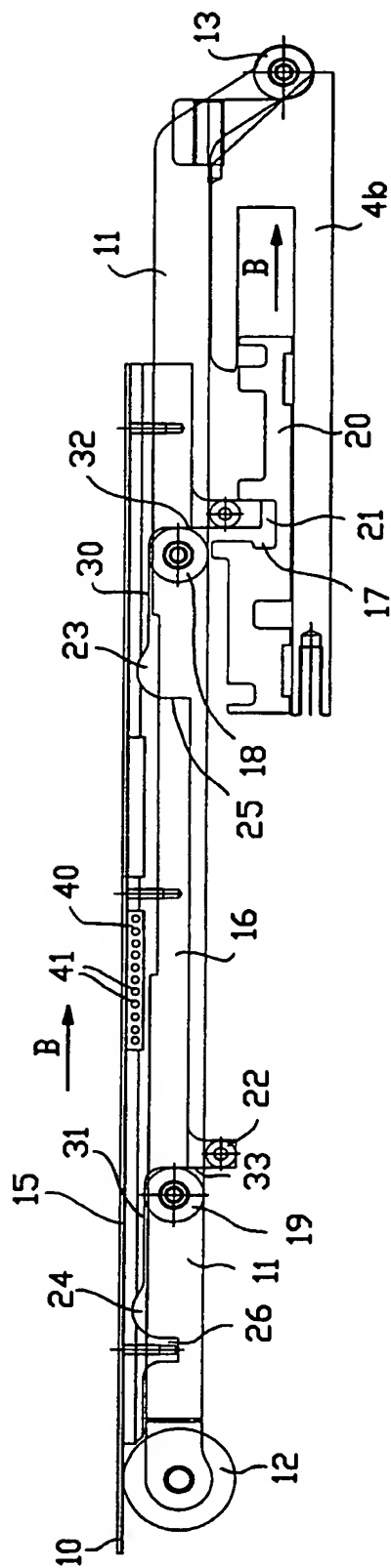


FIG. 2A

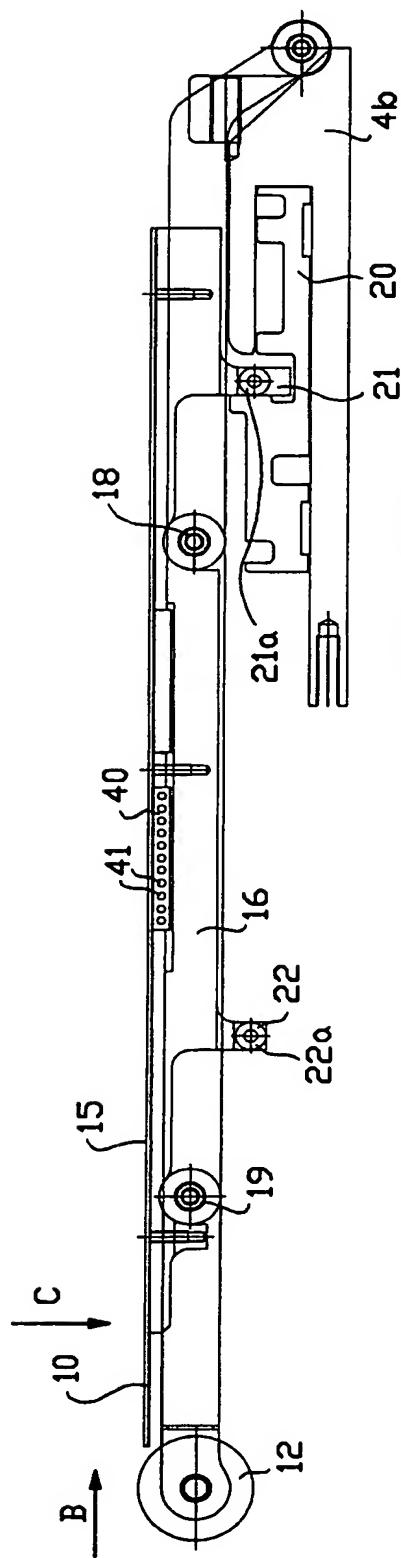


FIG. 2B

X

6/6

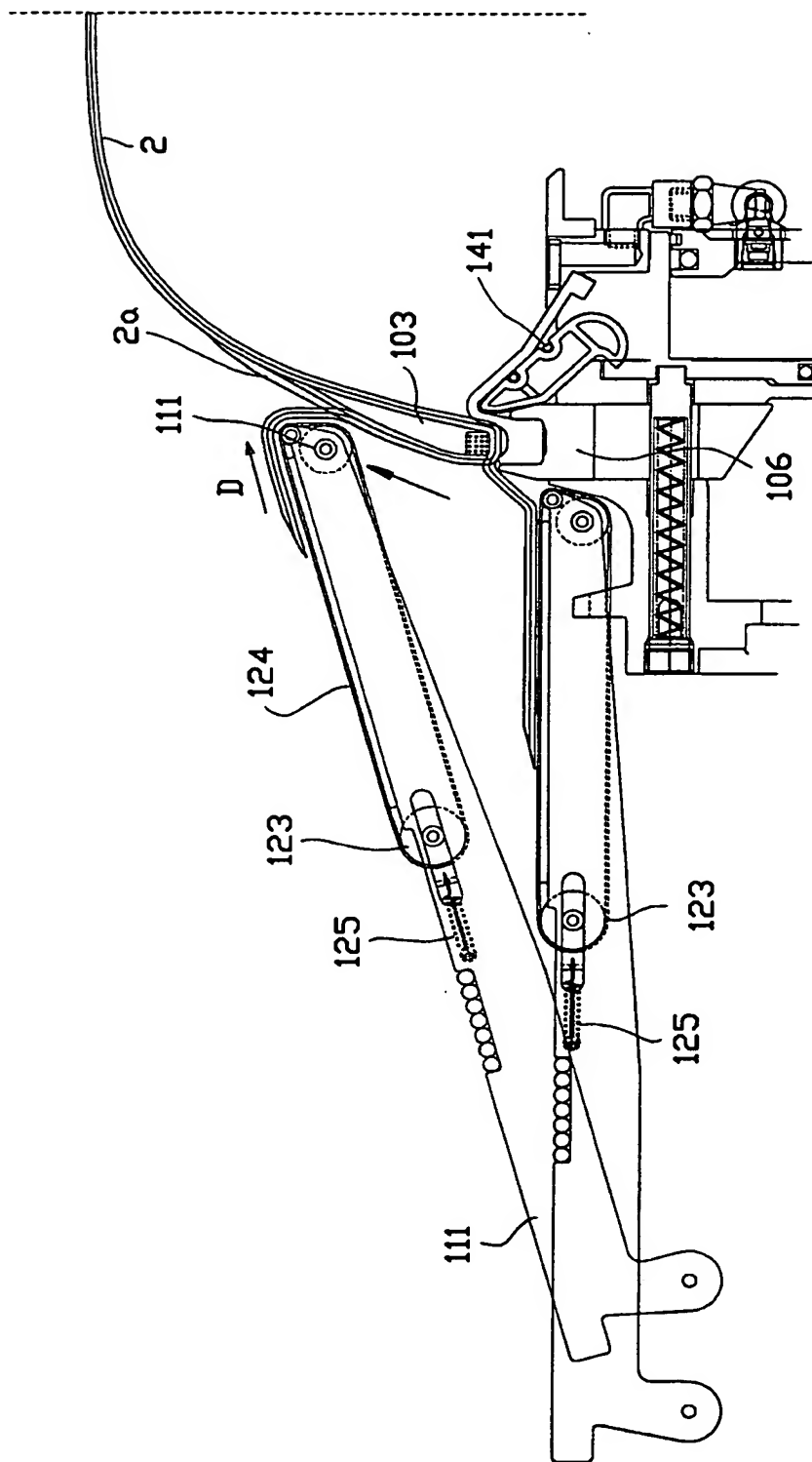


FIG. 3

INTERNATIONAL SEARCH REPORT

Inventor's Application No

PLT/NL 01/00219

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B29D30/24 //B29D30/32

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B29D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 093 531 A (A. H. FRÖLICH ET AL.) 11 June 1963 (1963-06-11) column 6, line 29 - line 33; figures 1,2,4 column 3, line 46 - line 52; figure 1 column 4, line 35 - line 47; figure 2 column 5, line 3 - line 26; figure 2 ---	1-16
A	WO 98 52740 A (BIERENS FRANCISCUS CORNELIS ;GUTKNECHT HEINZ (NL); VMI EPE HOLLAND) 26 November 1998 (1998-11-26) page 5, line 23 - line 36; figures 1,2 page 6, line 6 - line 19; figures 2,4,5 ---	1-16
A	FR 1 485 919 A (CONTINENTAL GUMMI-WERKE) 28 September 1967 (1967-09-28) page 2, column 1, line 4 -column 2, line 8; figure 1 figures 1-4 ---	1-16
	-/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

A document defining the general state of the art which is not considered to be of particular relevance

E earlier document but published on or after the international filing date

L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

O document referring to an oral disclosure, use, exhibition or other means

P document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

& document member of the same patent family

Date of the actual completion of the international search

8 June 2001

Date of mailing of the international search report

18/07/2001

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl.
Fax: (+31-70) 340-3016

Authorized officer

Fregosi, A

INTERNATIONAL SEARCH REPORT

Inventor's Application No.

PCT/NL 01/00219

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 484 973 A (KAWAIDA SHINJI ET AL) 27 November 1984 (1984-11-27) column 2, line 36 - line 57; figures 1,2 ---	1-16
A	US 3 173 821 A (H. W. TREVASKIS) 16 March 1965 (1965-03-16) the whole document ---	1-16
A	GB 2 182 894 A (BATES W & A LTD) 28 May 1987 (1987-05-28) the whole document -----	1-16

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inventor Application No

PCT/NL 01/00219

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3093531 A	11-06-1963	NONE	
WO 9852740 A	26-11-1998	AU 3466497 A CN 1254307 A EP 1001876 A SK 155299 A	11-12-1998 24-05-2000 24-05-2000 16-05-2000
FR 1485919 A	28-09-1967	DE 1579144 A	29-01-1970
US 4484973 A	27-11-1984	JP 59115829 A	04-07-1984
US 3173821 A	16-03-1965	NONE	
GB 2182894 A	28-05-1987	NONE	